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SAWDUST REPORT.

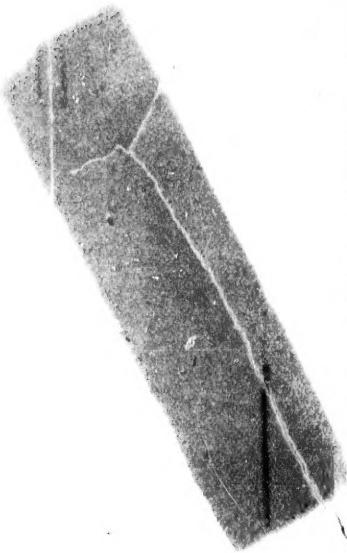
BY

W. H. ROGERS,

*Late Inspector of Fisheries for Nova Scotia.*

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## SAWDUST.

HON. C. H. TUPPER.

*Minister of Marine and Fisheries.*

Ottawa, Jan'y 1st, 1889.

HAVING had considerable experience in my younger days in both mill-ing and river fishing, I was early in life impressed by many facts and occurrences, which came under my notice from time to time, that saw-dust caused no injury in any way to anadromous fishes. I was never able to discover that they made any effort to avoid it in any manner, but on the contrary I usually found the greatest number of fish under the mill and where the sawdust was the most abundant. I do not, however, mean to say that the fish were found in such places because of the presence of sawdust, but because of the run of water escaping from the mill wheels, from which neither the continual pouring of the dust from the saws above nor the noise and clatter of the mill seemed to frighten them away. In this statement I will be sustained by mill men, resident river fishermen, as well, I think, by all having practical knowledge of the subject, and particularly, could a statement of their experience be obtained, by poachers. So well is this known by men employed in saw mills that during the salmon season, so soon as the mill is stopped for any purpose, a man or two will be seen under it with dip-net or spear endeavouring to capture the fish which have gathered there while the mill was in operation.

Since I have been connected with the Department of Fisheries I have had ample opportunity to obtain facts, and generally to pay closer attention to this subject. The rivers of this Province being numerous and small, and having been very generally utilized for water power and mainly for cutting lumber, mill dams and, as a consequence, sawdust are plentiful everywhere, and so are anadromous fishes. No country can therefore offer better opportunities for obtaining facts on this as well as on other matters connected with the fisheries. Nor are we wanting in Nova Scotia in incentives to investigation. Sportsmen are numerous and generally believe in the injurious effects of sawdust. Whenever any branch of the fisheries fails or the catch falls off for a year or two, sawdust is the one prime cause given. Hence, for over twenty years, the matter has been almost continuously pressed upon the attention of your Department: petitions and correspondence on the subject have multiplied, and many reports may be found on file in the Department from myself and other officers.

I have never to my knowledge communicated anything to your Department that I am not prepared to verify upon fair investigation. My statements are liable at all times to be looked into by the chief officers of the Department or by Parliament, and I therefore cannot afford to give misleading information, nor am I without ambition to be right on all questions pertaining to the fishing interests of this Province, and in some sense to be the humble instrument in their permanent improvement. Realizing the responsibility of the position I have

occupied from the time I entered the service, I have not only supplied myself with much of the existing literature on the subject of the fisheries, but have had much correspondence with men acquainted with the subject, both scientifically and practically, in many parts of the world. This, in connection with a personal experience of over twenty years in this Province, ought to have given me at least some knowledge of a subject of which so little is known by the general public, and upon which knowledge is so desirable.

Evidence to sustain the popular belief that sawdust is injurious to fish I have been unable to find, notwithstanding plenty of effort in that direction,—the advocates of that belief being driven to mere assertion and fancy to sustain their faith, while facts press themselves into public notice in abundance sustaining the opposite view.

It has been stated that the falling off in the catch of Shad in the Bay of Fundy was caused by sawdust, that the fish swallowed it and died in large numbers in consequence. The fact that ideas of this kind gained some credence led me to enquire more carefully into the matter, but not for my own satisfaction, as no such doctrine could be accepted by any person with the most limited knowledge of the habits of fish or the natural laws governing them. The same idea had been exploded several times before in the case of other branches of the fisheries, notably the Digby Herring fishery. My views and reports on this fishery will be found on file in the year 1879, and it will be seen that the state of that fishery since has fully sustained the position I maintained at that time. The average annual catch from 1870 to 1879, ten years, was 22,300 boxes, and from 1880 to 1887, eight years, 55,200 boxes. During the years 1877 to 1879, when the annual catch fell to about 5,000 boxes, sawdust was pointed to as the cause, and numerously signed petitions were sent to the Government pressing for the enforcement of the law. My view was stated to be that the decrease was merely owing to a periodical fluctuation, with which the sawdust had nothing to do, and that the fish would return in as great abundance as ever; and I appeal with full confidence to the facts as stated as substantiating my view after an experience of nine years has thrown its light upon the subject. In 1887 the catch of Digby herring amounted to 74,135 boxes, the catch for 1888 is only 12,200. We may therefore expect again that large numbers of petitions will be sent to the Government, asking the enforcement of the sawdust law, so as to save the Digby Herring fishery from destruction. The following from a letter lately received from Overseer Hanley of Digby is in point. After stating that he is of opinion that sawdust is injurious, particularly in large quantities, he says: "Yet I am unable to point out any facts from my own knowledge to sustain that opinion. During the past time since I have been in office, when no herring came into the Basin, when there were little or no sawdust coming down Bear River, the cry was that sawdust was the cause. Again, when sawdust was coming down the river in large quantities, large schools of herring have come into the Basin. It is impossible to account for the erratic movements of herring and mackerel. Take for instance the past season, when there was no sawdust at all worth speaking of, very few herring struck in, and of so poor a quality that they were not fit to smoke. Some struck in of a better

"quality in the latter part of the season, but too late to smoke. I may "be permitted to say here that at the head of St. Mary's Bay where "no sawdust or other deleterious matter has been thrown into the water "yet there were smaller quantities of fish there this season than ever "before, here is a problem for scientists to solve!"

It is quite true that sawdust is often found in the stomachs of fish, as well as other indigestible substances, but I have never seen a shad or salmon or any other fish that gave any evidence of having been killed thereby, nor have I ever found a man except in one instance at Minudie, Cumberland County, who had seen a fish that he believed was so killed. Sometimes a shad or salmon is found on flats in the vicinity of stake nets at low water which has fallen out of the nets as the tide ebbs away, and this is the case as frequently in localities where there is no sawdust as where there is, and there can be little doubt that if dead fish are found on the flats in the vicinity of nets, they have been killed by them. If sawdust is found in the stomachs of the shad it has been taken in by them along with their food, anadramous fishes it being well understood feeding only in salt water, taking nothing in fresh water. They do not masticate their food like animals, but the larger fish swallow the smaller, bones and all, and when the flesh is all digested, the bones pass away without any injury, the structure of the digestive organs being made to meet the conditions of fish life, just as birds are provided with digestive apparatus to meet the conditions of their life, and swallow gravel and other mineral substances without risk.

In Prof. G. Brown Goode's great work, "The Fisheries and Fishing Industries of the United States," pp. 594 to 610, will be found a very full account of the Shad and the causes of its migratory movements, and so forth, but not one word as to sawdust. On page 610 the Mud or Gizzard Shad is discussed, in reference to which is the following:— "They breed in summer and are supposed to feed like the menhaden "to a great extent upon the bottom mud, from which after swallowing "they separate the organic contents." These are not our shad, though a branch of the general family, and the fact stated is enough to show that fish do swallow indigestible matter without injury.

The following from Dr. James S. Miller, Overseer of Fisheries at Canning, Kings Co., will be of interest here:—

"In regard to the question of sawdust and its effects on fish, in my opinion it cannot be poisonous. If it was, the fish would be found in numbers, dead or dying, floating on the surface of the water in rivers where sawdust in large quantities is allowed to run. But I have never heard of any reliable person having seen such a state of things. I have seen shad on more than one occasion opened in which was found sawdust, but whether the shad swallowed the sawdust in the ordinary way as food, or whether it was swallowed in the death struggles, I am not prepared to say. This, however, I do know, that in no way did these fish appear different from their fellows. They were as fat, as large and as plump as any. Now if the sawdust was poisonous, one would expect to see some effect from it. Sawdust being woody fibre could not become poisonous without decomposition or fermentation. The cool spring waters that form our rivers, as well

"as the motion of the water, the currents, would prevent anything like  
"fermentation, as the water at any given place is constantly being re-  
"newed. I take it, therefore, that decomposition would be about  
"impossible under these circumstances, and I believe the idea of saw-  
"dust poisoning fish will have to be abandoned when the question is  
"more fully understood. From what I have seen and read, I am  
"satisfied that sawdust does not kill fish. Fish swallow many substances  
"that seem to be indigestible--anything bright or shiny, a piece of tin,  
"for instance--yet it does not kill them. What use it is to the fish I  
"cannot say. If not useful in the process of digestion, the fish must have  
"some means of getting rid of it at least; or it may be like the ostrich,  
"have a use for stones and many other substances that are indigestible.  
"In this country I cannot see how any person can hold the theory that  
"sawdust has poisoned the fish or driven them away. Fish have come  
"and gone: in all the past this has been the history of fishing in this  
"country. When the fish fall off, people attribute it to almost as many  
"causes as there are persons. When ships were first built on the shores  
"of Scott's Bay, the pounding was going to drive all the shad away.  
"Then it was the sawdust; and again the steam-mill would be sure to  
"do it, and so on *ad infinitum*; and all this time the shad came and  
"went according to their natural laws. The great trouble with the  
"fishery of this country, I am convinced, is the mill-dams and not the  
"sawdust. I mean the river fishery,—for if there is any cause other  
"than natural for the falling off in the shad fishery, I do not know  
"what it is. If the mill-dams were all supplied with good and efficient  
"fishways, I am satisfied the river fishing would improve. Mill-dams  
"have done more injury to fishing than anything else, not excepting  
"the terrible sawdust. Whether the sawdust fills up the rivers to any  
"extent, is in my opinion, or rather when the matter comes to be  
"properly understood, it will be the main question. It must be remem-  
"bered that those who have had the most experience say it does not,  
"that the Spring and Fall freshets in fact sweep the rivers out. No  
"right-thinking man would wish to injure the fishing interests of this  
"Province, neither would it be right to injure so important an industry  
"as the lumber trade, without very grave reasons; but if this sawdust  
"law is to be carried out in its entirety, it will about ruin the lumber  
"business in many places."

A very valuable paper by Prof. S. A. Forbes on the Food of Fishes will be found in the Report of the Fishery Commissioners of Illinois for the year 1884, pp. 90-127, in which he states what has been found in the stomachs of various kinds of fish. There are many able papers by scientists of distinction, as well as by practical men of every phase of the fisheries, published in the Report of the United States National and State Fisheries Commissions, and I have generally found the views before stated corroborated. The following from a paper by Prof. H. Rasch, of Norway, published in the United States Fishery Reports for 1880, page 517, gives an idea of how the sawdust question is viewed in a country where they have had a much more extended experience than we could have in a country so young: "That the rivers on which there "is considerable cutting of timber gradually become more and more

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"destitute of salmon is an undeniable fact, but while it is asserted that "the sawdust introduced into the river from the saw mills causes the "salmon coming from the sea either to forsake its foster stream because "of meeting the sawdust to seek another river not polluted, or else "when the fish attempt to pass through the areas quite filled with saw- dust, then this by fixing itself into the gill openings or between the "gills causes its death, yet later experience seems to entitle us to the "assumption that sawdust neither causes the salmon to forsake its "native stream nor produce any great mortality among the ascending "fishes."

"The river Drammen, below Hellefas, has for many years been greatly "polluted by sawdust, and the abundance of salmon decreased con- "stantly until the fishermen at Hellefas adopted the so-called artificial "method of hatching, whereby they supplied the river each year with a "considerable number of fry, which, after wandering to sea, returned to "the cataract, although the quantity of sawdust is the same as hereto- "fore; and one cannot see that the ascending fish is in any marked "degree affected thereby. The case is different when it reaches a "cataract where many saw-mills are situated, and there meets an insur- "mountable obstacle to its further advancement. Its desperate leap is "in vain; and as it is driven down exhausted in the water filled up with "sawdust, it will undeniably be liable to get some of it so tightly wedged "in the gills that it cannot get rid of it, and death will then sooner or "later be the result. To this danger the male salmon will be especially "exposed near and at the spawning time, since the increased length of "the so-called notches of the lower jaw prevent it from completely "closing its mouth. The salmon, which are not seldom found dead "after the spawning time, are nearly all males. That at the same time "most of the deaths result from violent struggles between rivals is "probable. If one could secure for the ascending fishes an easy "passage over the intercepting cataracts and dams, then certainly very "few fish would die from getting sawdust in their gills.

"That young salmon bred from a race of salmon which has its own "river, when they are set free in a strange river and one which is in "an unusual degree polluted by sawdust, will not be prevented by this "circumstance from returning to this last named stream after their "wandering in the sea, one had a convincing illustration in the great "experiment instituted last year by Director A. Hansen. In olden "times the salmon shoal, which had its spawning-place in Sali River, "could ascend to it through the then passable Sali cataract, but when they "for the sake of the increased mill business erected above the cataract "a dam so high that the salmon could not ascend to their spawning "ground, this salmon shoal gradually died out entirely. With the con- "sent of the mill-owners Mr. Hansen in 1868 constructed a hatching- "apparatus, which in November of the same year was supplied with the "pregnated salmon eggs, transported from the fishery at Hellefas. On "St. John's night, 1869, the young arising therefrom were liberated from "the apparatus into the river, partly above and partly below the dam. "Last summer a portion of the planting returned as young salmon, and "according to experience gained elsewhere, we should await for the "great body of them until the coming summer, because the greatest

"portion of them appear to pass the first two years of their lives in the rivers and two years in the sea.

"In case one could aid the advance of the salmon around the Sarp cataract or Sali cataract—and perhaps in this way a few less important waterfalls—and in connection therewith furnish the Glommen with artificially hatched young, one may now be fully assured that the abundance of sawdust which incumbers both branches of the Glommen, which again unite between Sarpsborg and Fredrikstad, will not prevent the salmon from going up to the falls, where they will then probably soon find access to a rightly constructed salmon-ladder, which would help them up to a portion of the great river freer from sawdust."

This article is thus quoted at length to show that the experience of the old world corroborates that of the new in this matter, and that in spite of sawdust, salmon as well as other fish will return to their native rivers and thrive. The writer seems to retain the idea that sawdust in some instances will kill fish, but there can be no doubt whatever and it is pretty generally admitted that it does not. Male salmon are continually killing each other in their struggles as the writer has pointed out, and it is quite natural to jump to the conclusion that when sawdust is found in their gills it was the cause of death, whereas it is safe to say that it has drifted there after the salmon has been killed.

Fish of all kinds are found in the foul and muddy waters of the Bay of Fundy and the bays and estuaries of rivers around it, and notwithstanding the abundance of all kinds of foreign and indigestible substances, as well as sawdust, they do not appear to mind it, but become fat and are the best flavored fish in the world. While the presence of sawdust and other foreign matter do not of course contribute to this fatness and good flavor, it is certainly apparent that they do not interfere with it. It is further clear that if sawdust killed shad or any other fish at certain times and at many places, large numbers of dead and decomposing fish would be found, in fact "winrows" of them would be blown upon shore, but no such thing has ever been heard of.

I am becoming more and more convinced as time passes that sawdust is of little, if any, injury to fish of any kind, and the expressions of opinion I have received in correspondence and personal interview with others of experience, have confirmed me in the views I hold. In December, 1880, Fishery Commissioner Stillwell of Bangor, Maine, wrote me as follows:—"In answer to your esteemed favor of the 28th ult, we have no reports or papers on the subject of sawdust. We have not succeeded in keeping it out of our rivers. It does not seem to seriously affect the anadromous fishes where thrown out below their spawning grounds: if thrown in above, I think it would. Our anadromous fish seem to make their way through it readily enough."

Henry O. Stanley, Esq., also one of the Fishery Commissioners of Maine, has written me lately:—"The Penobscot, which is the only salmon river, with the exception (perhaps) of the St. Croix, of any importance in our State that is now stocked with salmon, is full of sawdust at the lower end of the river, say for fifty miles up. I do not think that it injures them to any extent. They have free access to the head waters and can run up past the sawdust when they please. It

"does not seem to trouble them much in their way up, as they linger "along in the pools where the sawdust abounds, and seem to take the "fly readily. The famous pool at Bangor where most are taken with "the fly is full of sawdust."

He has had no experience as to the effect of it if lodged on the upper portions of rivers on the spawning beds, and thinks that in such cases it would injure the salmon fishery, and I am inclined to think so too, but I have never been able to find any lodged where salmon would spawn, as there is too much force of water in such places to allow it to remain, salmon always spawning in shallow, rapid running water. Some of our rivers have been receiving sawdust at their very head waters for many years, and one looks in vain for sawdust where there is any likelihood of salmon spawning. Maine has much more sawdust in her streams than we have and her officers are close and keen observers of long experience.

It will not be denied that there is and has been for very many years past more sawdust thrown into the St. John River than into any other in the Lower Provinces. Gibson's large mills and others on the Nashwaak, with numerous others all along the smaller streams which flow into the St. John on both sides from the Grand Falls down the river almost to its mouth allow all their dust to pass into the water. All the other large fish-producing rivers however are clean as to sawdust and yet the shad and other fish on the St. John are increasing, and decreasing on other rivers where there is little or no sawdust. The reports show the catch of shad since 1878 to be as follows :

1878—428 bbls.....	1883—1728 bbls.
1879—521 " .....	1884—2439 "
1880—615 " .....	1885—2189 "
1881—1885 " .....	1886—2716 "
1882—1883 " .....	1887—3793 "

This increase is in spite of the sawdust, and notwithstanding excessive fishing in the harbor and river, and that too while the fish are full of spawn early in May, when the destruction of a single fish is far more exhaustive to the fishery than that of fifty in the bay where they are not caught until midsummer, long after they have spawned. The Bay fishery has fallen off, in all parts of the bay alike, from 14,087 barrels in 1879 to 5,543 barrels in 1886. During the six years from 1876 to 1881, the annual catch of salmon in the St. John was 172,942 lbs., and the six years from 1882 to 1887 210,066, or an average annual increase during the latter period of 37,424; and of alewives during the former period of 10,018 bbls. per annum, and the latter period of 16,622 bbls., an average annual increase of 6,600 bbls.; so that, notwithstanding sawdust, the fisheries of this river seem to prosper. And what is still more remarkable, taking the whole province, the catch of salmon was during the nine years 1869 to 1877 on an average per annum 1,787,930 lbs., and during the ten years from 1878 to 1887 1,189,980, an average annual decrease of 597,950; and so in the case of alewives, the average annual catch during the former period was 23,053 bbls., and during the latter 15,339.

Surely these figures do not show that New Brunswick has any advantage over Nova Scotia in having rivers more free from sawdust.

I beg next to call attention to the state of the river fisheries in many parts of Nova Scotia where there is abundance of sawdust, and also to the river fisheries of Cape Breton where there is substantially no sawdust at all. The Margaree River in Inverness County, Cape Breton, which has neither mill-dams nor sawdust to interfere with its fisheries, and which used to be one of the most prolific fish-producing streams in Nova Scotia, has given a yield of salmon during the ten years 1870-79 of 67,927 lbs. per annum, and for the eight years from 1880-87 of 36,991 lbs., an average yearly decline of nearly fifty per cent. The catch of alewives on the same river during the former period was 1431 bbls. per annum, and during the latter only 826 bbls., a decrease of 505 bbls. per annum. Should there have been a few saw-mills on this river, the decline would have, of course, been attributed to sawdust, and demands that the law be enforced would be made. The four counties of Cape Breton, whose rivers are comparatively clear of sawdust, produced of salmon per annum, from 1870-79, 284,792 lbs., and from 1880-87 but 125,292 lbs., a decrease of 159,400 lbs. per annum. The following table shows the catch of salmon in the rivers of Nova Scotia proper where sawdust generally abounds, and also in the rivers of Cape Breton where the opposite is the case:—

Year.	Catch of Salmon in N. S. proper.	Catch of Salmon in the four C. B. Counties.
1880	232,890 lbs.	150,660 lbs.
1881	196,313 "	83,730 "
1882	468,956 "	111,155 "
1883	469,900 "	106,100 "
1884	601,850 "	146,100 "
1885	615,153 "	144,100 "
1886	499,574 "	109,600 "
1887	625,368 "	150,985 "

This shows that while there has been an increase during this period of nearly three hundred per cent. in Nova Scotia proper in the catch of salmon, there has been none whatever in the comparatively clean rivers of the Island of Cape Breton. The alewife fishery tells about the same story:—

Year.	Catch of Alewives in N. S. proper.	Catch of Alewives in Cape Breton.
1878	4,354 bbls.	1379 bbls.
1879	6,110 "	3279 "
1880	13,546 "	2599 "
1881	19,636 "	2837 "
1882	20,035 "	1621 "
1883	16,845 "	1503 "
1884	17,887 "	2801 "
1885	14,271 "	2443 "
1886	15,099 "	1713 "
1887	15,077 "	1513 "

There is surely no evidence here of injury to the alewife fishery of

Nova Scotia from sawdust nor of benefit to that of Cape Breton from its absence.

The Medway River in Queens Co. has been afflicted with sawdust for a full century. The dams were opened for the ascend of fish in the year 1873-4, with the following results and in spite of sawdust :—

Year.	Salmon.	Trout.	Alewives.	Smelts.
1878	22.871 lbs.	.....	70 lbs.	.....
1874	11.896 "	.....	262 "	2,000 lbs.
1880	5.323 "	.....	725 "	4,000 "
1881	7,615 "	.....	4,864 "	3,750 "
1882	8,388 "	.....	2,747 "	7,400 "
1883	21,169 "	915 lbs.	3,262 "	8,550 "
1884	20,315 "	1,650 "	3,082 "	15,200 "
1885	30,230 "	2,050 "	3,005 "	16,000 "
1886	22,005 "	2,378 "	3,505 "	18,250 "
1887	22,984 "	2,615 "	3,837 "	21,500 "
1888	18,450 "	2,775 "	2,916 "	22,700 "

Overseer John Fitzgerald of Mill Village, Queens County, an officer of eighteen years experience and an efficient and reliable one writes of the Medway : "There is without doubt an increase in salmon, alewives and trout during the past eight years. This is a matter of notoriety, and I have no hesitation in saying that sawdust is no impediment whatever to the ascent of fish of any kind. In rivers in which other mill rubbish, slats, edgings and bark are deposited, I firmly believe any decrease is due to the obstructions caused by these and the dams and not in the least degree by sawdust. Where sawdust is from any cause deposited on the spawning places and remains in such quantities as to cover up the gravel in which the ova are deposited, it might and probably would cause injury to the natural increase of the fish; but I know of no case of this kind and can confidently assert that no sawdust deposited on the spawning ground in the Medway. I have spoken with a score or more of persons all of whom have spent their lives on the Medway River, some of them old men, and all past middle life, and they are unanimous in the opinion that sawdust in the Medway causes no damages to fish of any kind, nor does it affect the spawning grounds in the least."

The Clyde River in Shelburne County was for many years before and since Confederation almost entirely barren of fish. We never received an account of a pound of fish of any kind from it until after the dam was opened by a patent fishway in 1879. Sawdust has continued to run into it for many years, and it is still running :—

Year.	Salmon.	Alewives.
1882.	.....	5 bbls.
1883.	.....	10 "
1884.	.....	20 "
1885.	350 lbs.	35 "
1886.	2,480 "	120 "
1887.	3,570 "	90 "
1888.	3,975 "	130 "

The natural and only rational deduction from this state of facts is, that the best way to stop complaints as to sawdust is to open the dams and make natural falls passable for all kinds of anadramous fishes.

The Liverpool River was also opened for the ascent of fish by a fishway in the Fall of 1879. This river is also supplied yearly with an abundance of sawdust, and such has been the case ever since the country was first settled. The river, too, has been much over-fished; but the table shows that notwithstanding both sawdust and excessive fishing, there has been a gradual and fairly satisfactory increase:—

Year.	Salmon.	Alewives.
1880.	2,800 lbs.	87 bbls.
1881.	4950 "	150 "
1882.	9980 "	15 "
1883.	14,121 "	70 "
1884.	13,269 "	333 "
1885.	7,730 "	126 "
1886.	11,449 "	46 "
1887.	9,210 "	125 "
1888.	12,615 "	140 "

The Tusket River in Yarmouth County, when I first visited it 1869, was nearly destitute of fish of all kinds. Its estuary was crowded with brush weirs, each of which was supplied with a pound or trap and in available places on the falls and in the runs and branches were stone fences running diagonally across the river, thus allowing but a few feet for the passage of fish, and here were located traps made with slats like common laths, so that nearly every fish that came up the river was captured. The river fishermen below blamed the fence trap fishermen above for the destruction of the fish, while the up-river men blamed the weirs. As all parties were fishing illegally I had all their obstructive appliances removed, and a new set of regulations were made with a view to keeping up the supply. The dams on the river were subsequently in 1881 or 1882 supplied with the new fishways, but during the whole time sawdust has been running into the river from several mills on different branches of the river. The following statement would not, however, seem to indicate that it has injured the river: The annual catch of salmon for six years, from 1876 to 1881, was 7,442 lbs., and from 1882 to 1887, six years, it was 11,362, while that of alewives during the former period was 2599 bbls. per annum, and during the latter was 3660 bbls.

The Salmon River, in the same County, which empties into the estuary of the Tusket, and which also was cleared of obstructions in 1869, with the exception of mill dams, produced in spite of the presence of sawdust from mills twelve to twenty miles above its mouth from 1876 to 1881, 778 lbs of salmon per annum, and from 1882 to 1887 2,440 lbs., and during the former period 826 bbls. of alewives annually, and during the latter 1,406 bbls.

The Gaspereax River, in Kings Co., in which sawdust has run plentifully for many years, and the dam in which was opened by fishways in 1883, gives the following results:

Year.	Salmon.	Alewives.	Trout.
1883	300 lbs.	10 bbls.	600 lbs.
1884	1500 "	200 "	700 "
1885	2000 "	350 "	1000 "
1886	300 "	450 "	1000 "
1887	2000 "	75 "	2000 "
1888	700 "	300 "	1000 "

The fluctuation in the catch of fish on this river is much affected on account of the modes of fishing by the height of the water in the stream during the fishing season, and hence the fact that the catch appears to be unusually small in any one year should not be taken as evidence of scarcity of fish. The best and most correct plan is in this as in all cases to take a number of years together and average the catch.

The rivers of Nova Scotia and Cape Breton together produced according to the returns the following quantities of salmon in the years indicated:

1880.....	383,550 lbs.
1881.....	279,943 "
1882.....	580,661 "
1883.....	575,940 "
1884.....	747,950 "
1885.....	789,293 "
1886.....	609,184 "
1887.....	776,353 "

The catch of alewives during the eleven years from 1869 to 1879 was 10182 bbls. per annum, and for the eight years from 1880 to 1887 18350 bbls. per annum, a result attributable, I believe, to improved fishways and better protection during the spawning season, and one which the presence of sawdust has not prevented. On receipt of Overseer J A. Torey's returns from Guysboro' for the present year, I noticed an unusual fall off in the catch of alewives in his district amounting to 1217 bbls., and enquired of him the cause. In his letter in reply he states: "As those fish resort in the spring of the year to fresh water to spawn, "no doubt some persons will take advantage of the shortage as an "argument against sawdust. Whether it is injurious or not, it does not "apply nor is it the cause of the deficiency in this case or in this dis- "trict, as we have no sawdust of any importance that reaches the mouth "of the river in any part of the district, and where the principal decrease "has been is where there are no mills nor ever have been. The only "way that I can account for the decrease (which is very unusual with "these fish) is owing to the dry weather which caused the streams to be "nearly dry at the season in which these fish usually approach the "shores, and in consequence of which they kept the deep water, or "off the coast, as the most that were taken were in the mackerel nets, "and a very few at the mouth or in the river as formerly."

There are several other rivers in this province, the catch of fish in which during a series of years would corroborate the results given as above in the cases of those referred to, but I think enough of this sort of testimony has been produced to satisfy anyone that sawdust cannot be ruining our river fisheries. Nor am I all alone on the views I have

expressed. I have in the foregoing report given the opinions of a number of competent persons, and beg to add to them the testimony of others who have given me an expression of their views on the subject :—

C. E. Godard, Overseer of Fisheries, Bridgewater, writes: "I inter-  
viewed a number of captains of schooners who have navigated this  
river for many years, and found their opinions as contrary as possible.  
" While some will tell you that the navigation is nearly ruined, others  
"will say they find no more difficulty now in sailing up or down than  
"they did at any time before. Captain Cashen says he finds as much  
"water now in the channel and as free from any obstructions as he did  
"ten years ago when he first took charge of the tug-boat—that during  
"the last summer he towed down a barque drawing 17 6-12 feet of  
"water without her touching bottom. He never towed one drawing as  
"much water before. Receiving such contradictory reports from cap-  
tains of vessels, as soon as the stormy and inclement weather would  
"permit I gave the places complained of a personal inspection. There  
"are two places, one opposite to the Chase mill, the other the Coves  
"at the Brick Kiln and Oaks' point below. At Chase's the river is  
"narrow, but I could not find any sawdust or other obstructions to  
"navigation. At the Brick Kiln Cove, the water is as deep as it was  
"five years ago. The mud flats opposite Oaks' Pond extend from the  
"eastern side of the river to about a hundred feet of the western shore,  
"where the deep channel of the river is. I did not find any quantity  
"of sawdust in these flats. The old inhabitants say the water on the  
"flats is not perceptibly shallower than ten years ago, but of course the  
"sediment washing down the river, spring and fall, would add some-  
"thing were there no sawdust made.

" This has been an exceptionally wet season, a continuous flood run-  
"ning down river during the whole summer, so that it has cleared to a  
"very great extent the sawdust from coves and channel. I find where  
"sawdust had accumulated for years now entirely free, and any previous  
"season no doubt a much larger quantity of sawdust would have been  
"found in the river. From my observation of the action of sawdust in  
"this river (LaHave) I am of opinion it would take very many years  
"before the navigation would be injured, and never in the channel,  
"which has generally from sixteen to seventeen feet of water in it. I  
"shipped deals from this place fifteen years ago, and the channel was  
"then no deeper, as sixteen feet was the deepest we could take down a  
"vessel at that time."

" I have watched the action of sawdust and found when it accumu-  
"lated a few feet appear to generate gas, and, as it were, boil up and  
"pass away. This has been frequently seen in the eddies formed by  
"the abutments at the bridge.

" I cannot see that sawdust does in any way injuriously affect salmon,  
"trout, alewives or shad in their passage to their spawning grounds on  
"this river. Salmon spawn in running water, in brooks or side of the  
"river, on sandy or gravelly bottoms, and any obstructions allowed to  
"accumulate sawdust at any of these places is injurious and destructive  
"to the spawn.

" The greatest injury to be avoided is from mills placed on the upper

" waters of a river, and in streams emptying into lakes, allowing the saw-dust to enter into the lake and drift into the coves and sink, destroying the spawning grounds of all the other fish. The fishing in several lakes where a good mess of trout could be had a few years ago is completely destroyed. That is the only injury that I can see that sawdust "has done to the fisheries in this river."

Overseer Godard used to hold strongly to the popular belief that sawdust was under almost all circumstances injurious and destructive of the river fisheries.

Overseer Reuben F. Reid, of Wolfville, Kings Co., says : " In respect to sawdust, I have no reason to think that it injures the Gaspereaux, for they appear to be increasing, the catch this year being the largest that I have known since I have had anything to do with the river. We often see them playing around the mill where the saw-dust is the most plentiful, when they might go nearer the ladder and escape it. I am sorry to say that the salmon are very scarce in the Gaspereaux River for the last two seasons. It is the general opinion that sawdust is the cause, but I am not prepared to say, as there have been large quantities taken at the Bay Shore, these having spawned in the Cornwallis River near Cold Brook, where there are several "saw-mills."

Overseer J. W. Davison, of Little Bass River, Colchester County, writes : " You wish to know my views for the cause of the decline in the catch of shad. I think that is a question hard to answer, and perhaps there may be different causes. As for the sawdust story there is nothing in it as far as this bay is concerned. There is no more sawdust going into the bay here than formerly, and I do not think as much. The steam mill in Economy burns its sawdust and there is very little of the sawdust from the rotary mills that goes into the bay, while formerly we had several gaug mills driven by water-power which let all the sawdust go into the bay. I never have seen any sawdust of any amount about the flats where the fish feed.

" Now in regard to the great decline there always has been in our shad fishery, ever since I can remember, a continual fluctuation, seldom more than from two to five years at once did it pay, but the decline is greater now than it has been since 1846. At that time there were but few weirs set, and I am told by one of the old inhabitants that his weir which was one of the best only caught one barrel, and people supposed they had left the bay and did not put in their weirs for a few years. However, they came back again and I believe they will do so now." Mr. Davison writes again : " With reference to sawdust I immediately sent out letters of enquiry to the leading fishermen in the extreme ends of my district, while I made enquiries of those whom I could see, so that I am now in a good position to answer your questions. The answer has been the same all through : no fishermen here has ever seen sawdust in the stomachs of shad and I will be very much surprised if it ever has been seen. I think the shad are as well qualified to judge suitable food as other creatures. I

"enclose a card received from T. J. Brown, Little Dyke, as I know him to be a very observing man. I wrote him and I send you his answer. " (As for seeing sawdust inside of a shad it is something I never remember seeing, and I have examined a good many in my time. I examined some this summer)." Again Mr. Davison writes: "I have continued my enquiries as to whether fishermen had ever seen sawdust in shad, and am unable to find the man who ever saw or heard of such a thing."

Overseer James A. Torey, of Guysboro', says:—"Respecting my personal experience of the effect of sawdust on fish in the rivers and streams, I must say it is very limited, as my district has not been overburdened with that commodity. Where the quantity is small, it has been invariably carried away by the stream or current, and no injurious effect has been seen; but where the quantity is large and there is not a heavy current to sweep it off, it water-soaks and sinks to the bottom, upon which I think fish will not rest, as their nature seems to be to search for clean gravelly bottom. Mills, generally speaking, are built upon branch streams, and in those branches or between the mill and the main stream fish are not generally found. Whether it is the sawdust or the dam is the cause I am at a loss to know, but I believe the latter is the principal cause. The old story about fish eating sawdust and thereby killing themselves, I don't believe a word of it, as their own instincts forbid such an idea. Where mills are erected on the main stream, with a flow of water sufficient to carry away the sawdust, I have found fish as plentiful at the tail of the mill as in any other part of the stream, and oftentimes more so. The dam is the 'stopper,' not the dust. I am of opinion that, if dams were made passable, and other obstructions cleared from the rivers, sawdust would not be so objectionable."

Overseer George W. Gilroy, of Oxford, Cumberland County, writes: "In my opinion the sawdust does little or no damage to salmon or other fish, especially in the time of the spawning season, as at such times fish are found in the streams in running shallow water where the sawdust is carried in the eddies away from such places where the fish deposit their spawn. I have paid very close attention for the past twenty years to the River Philip, and I believe the fish are as plentiful now as they were twenty years ago; and if good fishways were kept in the mill-dams, and all rubbish such as edgings, bark, etc., were kept out of the streams, I do not think there would be much complaint about sawdust going into the streams, or any reason for such complaints."

George Rawlings, Overseer of Fisheries, East Halifax, writes: "My opinion is that if the mill-dams had good fishways and the water kept in them properly, it would be a greater benefit to the fish than keeping the sawdust out of the water. The principal reason I see for keeping the sawdust out is where it fills up shallow harbors and prevents small vessels from lying close to the shore. I have enquired of several persons here who catch salmon with nets, and they object to

'the sawdust because they say the fish will not net so easily, as they "see the net plainer. The mill at the head of the tide at Musquodoboit Harbor has been running some twelve years, and the salmon and "trout are still plentiful. Of course the dam has injured the fishery, "and I think most all will admit it has been the dam and not the sawdust. I think Mr. Wilmot could say that if the fishway here (Musquodoboit Harbor) had been kept closed while the salmon were running, he would have taken as many this fall as in any previous years, "unless it was some extraordinary one. All the sawdust from Hart's mill goes into the water, and I have not heard any person complain "of it doing any injury to fish more than filling up the harbor, and the "salmon have been very plentiful at West River during the last ten "years where his mill is."

Many other references to the subject will be found in the Overseer's Reports accompanying the returns, both *pro and con.*

I would not pretend to say that sawdust may not, under some circumstances, injure a harbor or river for the purposes of navigation, though such circumstances are rare in this Province. Some years ago it was repeatedly and publicly asserted that the Davison mills at Bridgewater were filling up and ruining the harbor at the mouth of the LaHave river. Under instructions from the late Mr. Whitcher, then Commissioner of Fisheries, I made a careful personal examination of the river, and reported Oct. 1, 1876. The subject was again renewed by the report of Mr. Veith, and I was again directed to make an examination and report. This was done, and a report was forwarded to the Department May 14, 1881. The river was found just about the same as at the time of my first report, and I have no doubt that an examination at the present time would reveal about the same state of facts, and that the clamor as to the sawdust filling up the LaHave is misleading.

In conclusion I may say that those who affirm that sawdust injures the fisheries to the extent claimed by them should be in a position to show facts and produce instances clearly proving their assertions. This should, of course, have been done before their, in my opinion, untenable views were placed in the form of law; but even now that the law has to a large extent been allowed to fall into desuetude, and when the important milling interests of the country are likely to be so seriously affected, there should, I think, be a careful examination or enquiries into the whole subject.

I have the honor to be,

Sir,

Your obedient servant,

W. H. ROGERS,  
*Inspector of Fisheries.*

## ADDENDUM.

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### A CENTURY OF SAWDUST.

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*Editor Forest and Stream:*

I was delighted with the intelligent way in which your correspondent "Piscator" handled the Sawdust question in your issue of Dec. 27th. It is a comfort to listen when a well-informed person speaks, but in those days of callow pretension experience is usually elbowed back from the front.

In my opinion, the famous Mill Brook, of Plainfield, Mass., which has a record of a century as the finest trout-water in the Hampshire Hills, supplies those very conditions and corroborative data which "Piscator" declares are essential to determine what pernicious effects the presence of sawdust has upon the denizens of mill streams. Here is a waterpower which carried no less than thirteen manufactories fifty years ago. These included a tannery, a sawmill, and factories for making brush and broom handles, whipstocks and cheese and butter boxes, all of which discharged more or less sawdust and shavings into the stream; to say nothing of three satinet factories and a felt hat factory whose waste must have been deleterious to fish life. Most of the buildings have since been destroyed by fire or tumbled into pieces by decay, but the old foundation walls and dams remain, and untold tons of tanbark and sawdust still cover the beds of the abandoned mill ponds knee deep, all of it in a perfect state of preservation, as I happen to know from wading the stream last summer. Nevertheless the brook continues fairly stocked with small trout, despite the supplementary fact that it has been unmercifully fished ever since the memorial days of the "Mountain Miller," fifty fingerlings per rod being not unusual now for a day's catch. Besides, at no time within my recollection have there been less than three sawdust-producing mills on this stream at once, so that it may be asserted that its waters have not been normally clear for a century.

When the current is rapid and the water broken by ledges or boulders, the presence of the sawdust is scarcely perceptible, but at mill-tails, and in the basins above the dams, it accumulates in quantity and remains, becoming water-soaked and sinking to the bottom. Obviously, in localities where the entire bottom is embedded by sawdust, fish can neither spawn nor feed; but it happens that such deposits do not form on their breeding places, nor is the area of their foraging ground appreciably diminished by their presence. Even in the half-emptied and now useless ponds, the current constantly scours out a central channel through the sawdust, leaving the bottom clean and pebbly; so that in fact these local beds are of no more detriment to the fish than so many submerged logs. The trout can range far and wide without encountering them at all. Yet strange to say—that is, it must seem strange to those persons who take it for granted that sawdust kills fish—the most likely places for the larger trout are these selfsame pebbly channels in the old ponds, along whose edges, despite a hundred freshets and iceshoves, the persistent sawdust and tanbark lie in winnowrows so deep that the wader feels as if he were going to sink out of sight whenever he puts his foot into the yielding mass, every movement of which stirs up a broadening efflorescence which spreads for rods away, distributing itself throughout the stream. From these sawdust beds I can always fish out three or four good trout with a cautious fly, and at certain times the surface is fairly dimpled with breaking fish which presumably are after larva and insects which the sawdust has harbored, though careful investigation might discover other inducements for their congregating there.

In passing, I would remark, that this Mill Brook is fed by seven lateral brooklets which tumble into it from the adjacent hillsides at intervals between dams, and are so effectively protected by overgrowth that they must always serve as prolific breeding

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places, secure from predatory birds and small boys, as well as places of refuge to trout which wish to escape the sawdust of the main stream. I have seen trout streams, especially in the pine barrens of northern Wisconsin and Michigan, which were by no means as favored as this Mill Brook, the current being comparatively sluggish, and not so capable of purging itself of sawdust; yet I know of few trout streams in any lumber region where its denizens cannot avoid the sawdust if they will, by withdrawing to the headwaters of or lateral tributaries, provided fishways are supplied to enable them to surmount the dams where the accumulations chiefly occur. What I remark as most singular in the Mill Brook is, that the trout gather most where the sawdust is thickest, both on old mill sites and on sites where mills are running now. I take my best trout right from under the flume of a whipstock factory and saw mill, where the refuse is dumped as fast as it forms.

But I recall to mind a still more striking example of the innocuousness of sawdust. There is in Hampshire county, Massachusetts, a series of three large natural reservoirs, varying from half a mile to two miles in length, which for fifty years have abounded in pickerel, perch, eels and bullheads. It is said that they originally contained trout, but the water is dark and discolored by the drainage of spruce and cedar swamps. At the outlet of the lowest pond once stood a village called Hallockville, which operated a grist mill, sundry sawmills, and what was then the largest tannery in Massachusetts. It was burned in 1846 and never rebuilt, and the dams and foundation walls are now almost destroyed and buried by a new growth of forest. But the sluice and flood stream below are still clogged with the sawdust and tan bark deposited a half a century ago, and the water is black and forbidding, though much broken into swirls and rapids by boulders and ledges. But for the color of the water, it is a most likely-looking place for trout, though it has been tested time and time again without successful results. It has always been maintained, from the date of the building of the tannery, that there were no trout in it. I used to fish it myself when I was a boy. Last summer I took therefrom five small trout with a worm. They had doubtless worked their way up from the Buckland streams below, for they never came through the dam from the pickerel ponds above. Nevertheless the lower streams are occupied by many sawmills and carry their proportion of sawdust, that substance which some of your correspondents maintain is fatal to fish life. I leave your readers to draw their inferences, and trust that Mr. Fred. Mather will feel himself sustained by this testimony of the streams. That gentleman is not apt to make mistakes. He is gray with the experience of years, and that is better than guesswork.

CHARLES HALLOCK.

WASHINGTON, December 29.

### THE SAWDUST QUESTION.

*Editor Forest and Stream:*

I have read with interest the various communications upon the above named subject, and with special interest that of Chas. Hallock, in this week's issue, because he refers to streams and conditions with which I am familiar, and I write from an invalid's room to briefly corroborate the facts stated by him. The adjoining township west of Plainfield is Windsor, a much larger township and containing many more streams and trout streams too. Adjoining Windsor on the south is the township of Peru, where first I saw daylight. This township also abounds in trout streams known as the Hoosac Tunnel Range or Spur of the Green Mountain which cross the western end of the state of Massachusetts. A large portion of these streams have driven sawmills for a century past, and several of them had tanneries on their banks, and the same state of things, practically, as enumerated by Mr. Hallock, has existed there for one-third to one-half a century past to my personal knowledge.

MILTON P. PIERCE,

Columbia, Ohio.

[Mr. Pierce is editor of "Journal of Fish Culture," Philadelphia, a gentleman of much experience, and has been connected with the National Fish Commission for some time.]

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From the foregoing survey it will be evident that there are two sides to the question as to the influence of sawdust in streams and lakes, and it may be possible that some of the States which have legislated against the deposit of this substance in certain waters have placed unnecessary restrictions upon an important industry. Unless spawning grounds are actually covered and feeding grounds destroyed, there would seem to be no case against the sawdust. At all events, the instigators of this legislation should produce evidence of deleterious effects to be remedied by legal enactments, and show that such pollution is necessarily and always fatal and cannot be mitigated by measures to aid the scene to the spawning beds.—*Ed. Forest and Stream.*

*Editor Forest and Stream:*

Let me thank Mr. Hallock and Mr. Peirce for their cool-headed utterances on this sawdust question. I have been for many years investigating this subject, and have under my hand many such facts as I published in my former letter, and it is cheering to have them so effectively buttressed as they have been by similar experiences and facts. That laws have found their way upon the statute books of the country prohibiting the passing of sawdust into the streams is not proof that to do so is an evil. Many other laws have found their way there as well only to be repealed after more was known upon the subject, and I feel quite sure that the law against sawdust ought to and will share the same fate, and because it never should have been enacted, as the necessity for it does not really exist.

At the risk of wearying you on the subject, I add a few more facts, which to me are quite significant. The River St. John, in New Brunswick, is only to a limited extent on its branches encumbered with mill dams, but it is and has been for nearly a century abundantly supplied with sawdust, still it produced during the six years from 1876 to 1881, of salmon, an annual average of 172,942 lbs., and during the six years from 1884 to 1887 210,366 lbs., an excess during the latter over the former period of 224,544, lbs. Its product of alewives during the former period was 10,018 bbls. per annum, and during the latter period 16,622 bbls., an increase during the latter period of 39,624 bbls. The fish killing properties of sawdust do not seem to be very formidable on the river, though much of it is of that horrid pine which "Sportsman" seems to think is so deadly in its results. The following catch of shad on the river during the years indicated also tells its own story in the same direction: 1878, 429 bbls.; 1879, 521 bbl.; 1880, 613 bbls.; 1881, 1,885 bbls.; 1882, 1,882 bbls.; 1883, 1,728 bbls.; 1884, 2,420 bbls.; 1885, 2,189 bbls.; 1886, 2,716 bbls.; 1887, 3,950 bbls. These fish were mostly caught during the month of May while full of spawn.

The whole Province of New Brunswick with her large fish producing rivers, except the St. John, clear and clean of mill dams and sawdust, produced of salmon per annum during the nine years from 1869 to 1877 1,789,930 lbs., and during the ten years from 1878 to 1887 but 1,189,180 lbs., a decrease of 599,950 lbs. per annum, and alewives during the former period 23,053 bbls. and the latter 17,714 bbls. per annum, a decrease of 5,339 bbls. per annum. Those figures of course include the St. John, so that while anadromous fish of all kinds are increasing on the sawdust-cursed St. John by including the produce of her clean rivers, we see there must be something at work much worse than either dams or dust. Had the reverse of these figures been the result he would be a much bolder man than I who undertook to prove that sawdust did no harm; but as it is I claim that I have made a strong point in favor of the innocence of sawdust. If the deadly dust is as ruinous to fish as some suppose, it should produce results in a series of years which could leave no doubt upon the mind of any person.

The very best thing to be done for anadromous fish in your country as well as ours is to put good fishways in the dams at any cost and add to the fish year by year by artificial culture, and the imaginary sawdust evil will soon vanish and the lumbering interests will be saved a needless expense.

Your New Brunswick correspondent "Fisher" seems to think that I am not informed as to the enormous size of the New Brunswick trout, which he seeks to make one think are very whales as compared with the troutlings of Nova Scotia, which he intimates are too small to be killed by sawdust! When he takes this singular position, he proves nothing so much as that he and his companions—in the contention that sawdust kills fish—are advocating error and wrong, because no two of them can agree

as to how or why it is so destructive; see Livingston Stone's view as compared with "Fishers" and "Anglers." There are as many theories as writers; but all are provokingly economical of facts, and it is facts we want: we have been familiar with the groundless theories from childhood, and it is about time the theories were supported, to some extent at least, so give us data and don't ask us to take fancy for fact.

As to the size of trout in Nova Scotia, I have seen thousands that weighed from 1 lb. to 4 and 5 lbs., and one to a half dozen may be seen in the museum at Halifax weighing from 5 to 7 lbs. They catch double the quantity every year taken in New Brunswick. It is quite evident "Fisher" should be more sure of his facts. His Province produced of trout in the year 1886, 65,650 lbs., and Nova Scotia the same year, 131,562 lbs., double the New Brunswick catch; and in 1887 the former Province caught but 71,765 lbs. in her clean rivers, while the latter Province in her sawdust poisoned waters caught 155,469 lbs., being 11,939 lbs. more than double that of New Brunswick, the increase in Nova Scotia in a single year being nearly 20 per cent. as compared with less than 10 per cent. in New Brunswick. Had the result been the reverse of this the facts would at once be accepted as conclusive against the deadly dust; as it is I claim them as being overwhelmingly in the opposite direction.

He discourses on the poisonous gases from rotting sawdust, and I will not waste space in refuting this idea, so flippantly put forth from time to time, but demand that the dead fish from such causes be produced in some single river or stream in America. It cannot be done, hence full-grown men should discard such transparent nonsense. His closing remarks are fully answered by the facts and figures given above. I am prepared to figure on either single rivers, whole Provinces or districts, on single or periods of years, and the facts in all cases will be overwhelmingly against his contentions. This is too important a matter to be settled either one way or the other without conclusive facts, and if sawdust so kills fish as to deplete our streams, facts in the form of dead and dying fish should be at hand in all directions, and by hundreds and thousands on certain streams and at certain seasons, but nothing of the sort is ever seen, except in the imagination of the disappointed sportsman.

PISCATOR.

## EFFECT OF SAWDUST ON FISH.

*Editor Forest and Stream:*

Your correspondent "Sportsman," who writes on the evils of sawdust, seems to me like most others who hold the same views, to take for granted the thing to be proven. The *onus probandi* being with him who affirms, I state the statement that "sawdust kills fish" by fastening itself in their gills. "Sportsman" says: "After sawing pine in a mill I have gone along the stream and picked up dead trout, and upon examination found their gills to be full of pine sawdust, which, without a doubt, kills them. I can name several persons who have witnessed the same thing." But finding a dead trout or two with sawdust in their gills is no proof that the sawdust did the killing. Those who are familiar with rivers and river fish know that when a fish dies, from whatever cause, its gills will open, and if sawdust is running plentiful in the water some of it is likely to lodge in the gill openings of a dead fish. I have seen one or two such cases, but evidence was there also, plain and clear to an experienced eye, that the fish had died from other causes. Moreover fish don't allow anything to get into its gills which is likely to kill it, except by accident. It is provided with the necessary instincts and means for protecting them from all or any such foreign substances as sawdust; if not, we should long since have lost about all the anadromous fishes in our streams, and at certain seasons, and in certain places, large numbers of dead, struggling and dying fish would be seen in, upon and about the surface and shores of rivers. But such is not the case; no such sights are seen.

In order to sustain his views "Sportsman" should produce some stream where the fish have either been wholly destroyed or largely decreased, where plenty of sawdust exists, while dams have been opened so that the fish have had ready access to their spawning beds above. Such a case, I think, cannot be found on this continent, unless indiscriminate fishing has been allowed at all seasons of the year. I herewith produce tables showing the catch of fish on two, out of a dozen or more, similar cases

in Canada. Sawdust has been running into these two small streams for six to nine months of the years for over half a century. Impassable mill dams at the head of salt water had completely depopulated the Clyde, and nearly did so on the Medway, which fared better because the dams were further up the river. The dams on the former were opened in 1879, and on the latter a few years earlier, but in both cases the sawdust continued to run freely, as it does still.

## CLYDE RIVER, NOVA SCOTIA.

	Salmon, lbs.	Alewives, bbls.
1879. Dams opened .....	—	—
1880.....	—	—
1881.....	—	—
1882.....	—	5
1883.....	—	10
1884.....	—	20
1885.....	300	35
1886.....	2,480	120
1887.....	3,570	90
1888.....	3,975	130

## MEDWAY RIVER, NOVA SCOTIA.

	Salmon, lbs.	Trout, lbs.	Alewives, bbls.	Smelts, lbs.
1878 .....	22,871	—	70	—
1879 .....	11,896	—	262	2,000
1880 .....	5,313	—	725	4,000
1881 .....	7,615	—	4,864	3,750
1882 .....	8,388	—	3,747	7,400
1883 .....	21,169	915	3,262	8,550
1884 .....	20,315	1,650	3,082	15,200
1885 .....	30,230	2,050	3,005	16,000
1886 .....	22,005	2,375	3,505	18,250
1887 .....	22,984	2,015	3,837	21,500
1888 .....	18,450	2,775	2,966	22,700

Sawdust in large quantities has not killed the fish here.

I have never yet been able to obtain any such facts to sustain the opposite view. This is an age of investigation, and few things are taken for granted in the absence of facts or evidence to sustain them; and we have a right to ask of those who claim that sawdust is ruinous to fish to produce their proof.

"Sportsman" is also in error when he says that sawdust covers up the spawning beds. I have never been able to discover such, and I have examined many rivers for that purpose. The fact is, the current is too strong where a salmon or trout would spawn to allow it to remain, hence such spawning beds are as clean to-day as ever they were, no matter how much sawdust has been coming down the river. But even if it should lodge in such places, he must prove by actual facts how and why it would injure them.

Sawdust does not rot under water, nor does wood of any sort, where it mingles with sand or mud in coves along the shores or about the heads of estuaries where the water settles away from it by the ebbing of the tide, or in fresh water. When it is left dry in summer, it will of course rot and soon disappear, and by far the greater portion of what falls into the streams from mills driven by water power disappears in that way. So far as I have been able to ascertain, the fish-killing effects of sawdust in any way or place has yet to be proven, and until such indubitable proof is produced, I, for one, shall continue to disbelieve it. I have had considerable experience in this matter, but am always willing to bow to well-authenticated facts. The matter is an important one and calls for intelligent settlement, and, in my humble opinion, it is not difficult to settle right.

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